1. Claim Amendments

The Applicant has amended claims 1, 5 and 9-12 and claim 4 has been canceled. Applicant respectfully submits no new matter has been added. Accordingly, claims 1-3 and 5-30 are pending in the application. Favorable reconsideration of the application is respectfully requested in view of the foregoing amendments and the following remarks.

2. Priority

The Applicant thanks the Examiner for acknowledging Applicant's claim for foreign priority.

3. Double Patenting

The Examiner provisionally objected to Claims 1-30 on the ground of nonstatutory obviousness type double patenting as being unpatentable over claims 1-22 of co-pending Application No. 10/550,241. The Applicant has filed herewith a Terminal Disclaimer with respect to co-pending Application No. 10/550,241 to overcome this objection.

4. Claim Rejections – 35 U.S.C. § 102(b)

Claims 1, 2, 4, 5, 7, 8, 10, 12 and 17 stand rejected under 35 U.S.C. 102(b) as being anticipated by Hoffman (US 6,061.702, hereinafter, Hoffman). The Applicants have cancelled independent claim 4 rendering the rejection of that claim moot. The Applicants respectfully traverse the rejection of the remaining claims.

The Examiner states:

> Regarding claims 1,2, 4, 5, 7, 8, 10, 12 and 17, Fig. 1 of Hoffman discloses a device for generating a noise signal [SCLK], comprising;
>
> a noise source for generating intrinsic noise, the noise source further comprising:
>
> noisy amplifier cell having amplifying means [noisy amplifier comprising MOS transistors 18 and 19];
>
> a load [PMOS 16] coupled to the amplifying means and a power supply [Vec]; and

> a tail-current source [NMOS 19] coupled to grounding means and to the amplifying means.
>
> The amplifying means comprises a common-source amplifier (the sources of 17 and 18 are not used as input or output). The resistive load 16 is cascoded with PMOS 17. A first amplifier cell [11] is provided DC coupled to the noisy amplifier cell; and the output terminals of the noisy amplifier cell are coupled to respective input terminals [12, 13] of the first amplifier. The design of the first amplifier and the noisy amplifier correspond to each other, as they are both designed to develop the noise-based random control signal 14 to the VCO 10 to develop a random clock signal. The input terminals of the amplifying means of the amplifier cell 11 are shortcircuited to a fixed DC potential established by MOS transistors 16-19 at node 15.

However, the Examiner has incorrectly mapped the elements of Hoffman to the present invention. In Hoffman, transistors 16-19 form a voltage divider generating a bias voltage 15 roughly midway between Vcc and ground—these are not configured as an amplifier and hence are not equivalent to the amplifying means of the present invention. In fact, in Hoffman, transistors 16 and 19 act as switched resistors. In the EN state they act as resistors enabling operation of this bias cell. Further, transistors 17 and 18 are "diode-coupled" MOS devices. If it is Examiner's position that these elements are common-source amplifying devices forming an inverter with transistors 16 and 19 acting as source series feedback devices, then such an amplifier would have shorted inputs (gates of transistors 17 and 18) and outputs (sources of transistors 17 and 18) providing no gain at all. In such case, node 15 will be a low impedance node (roughly the resistance of (Rds) 16 and 19 in parallel) with low noise. Thus, node 15 is just a DC bias potential with relatively low noise. Another problem of equating these elements of Hoffman to the present invention is that any supply (Vcc) *noise* would be copied to node 15 and should the supply noise contain traces of on-chip clocks (very likely in a digital circuit) these clocks will be superimposed on node 15 making this "noise" systematic rather than random. To ameliorate this, Hoffman adds a differential amplifier 11 to suppress any noise in node voltage 15. Assuming ideal common-mode rejection (i.e. infinite CMRR) there will be no traces of the noise at node 15 (including cross talk from Vcc) at its output 14. In practice this will not be the case and node 14 will

not be a good noise source, either. In addition to this, a slight offset in the input stage of 11 will be amplified causing node 14 to approach either Vcc or ground depending on the offset polarity. For a typical operational amplifier, a DC gain would have to be large enough such that the input offset times the gain exceeds the supply voltage and in practice such an amplifier would saturate at either supply rail.

As can be seen, the invention of Hoffman lacks the practical aspects of the present invention, namely noisy differential bias point with high supply interference suppression (PSRR). Furthermore, the noisy amplifier in Hoffman lacks the bias feedback network claimed in the present invention. This network does not rely on anything but MOS devices to generate a high "noise" gain with a stable operating point and high PSRR.

There are additional higher level differences between Hoffman and the present invention. For example, Hoffman uses a voltage divider to bias the differential amplifier. This voltage divider is actually called voltage divider by Hoffman and cannot, thus, be a common source amplifier with cascoded loads as claimed in amended claim 1. Hoffman further states that the noise source is the set of two resistors connected between the voltage divider and the amplifier. Thus, Hoffman relies on these resistors and not the amplifier as a noise source. The amplifier then amplifies the "difference noise" and modulates a VCO by this amplified signal. Hoffman does not discuss PSRR nor disclose elements that make the amplifier noisy or insensitive to disturbances. Furthermore, the amplifier disclosed by Hoffman runs open loop with no provision for setting the optimal bias point. In contrast, in the present invention, a feedback network is provided that accomplishes this as well as shaping the over-all gain to give a very noisy output. In the present invention, it is the combination of a noisy amplifier biased at its optimal operating point, but using standard CMOS-compatible components as the noise source. No resistors are used.

The Examiner further argues that Figure 1 of Hoffman discloses elements of the present invention. Specifically, transistors 16-19 are mapped to a noisy common-source amplifier with a resistive load 16 cascoded with 17. This mapping is incorrect in

several respects. Hoffman refers to this sub-circuit as a voltage divider (col. 2 lines 24-26). In fact 16 and 19 are just switches that either connect 17 and 18 to the supplies or disconnect them. The voltage division is formed by the "diode connected" transistors 17 and 18 which will balance their gate-source voltages such that the same current flows through them. This mid-point voltage is then used as bias for the following differential amplifier. Any noise in this bias point is suppressed by the amplifier as this is a differential amplifier, Hence transistors 16-19 only work like a voltage bias and has no significant, noise contribution. The noise comes from the two resistors 12 and 13 and the difference in their instantaneous noise voltages is seen as input by the amplifier. As bias fluctuations do not generate any significant difference in voltage, such fluctuations do not contribute to the output. A problem with Hoffman (compared to the present invention) is that Hoffman uses high-valued resistors which may not be available in a typical digital CMOS process. Another significant problem is that any DC offset in the differential amplifier 11 will cause its output to be stuck at either supply rail (positive or negative depending on the offset polarity) due to the high gain of the amplifier. For example, typical amplifier offsets range from 100uV to 10mV (depending on design targets) and with a supply voltage of, for example, +/- 1.5V, an amplifier DC gain of 300-30000 suffices to make node 14 stuck at either supply rail. Such DC gains, and those much higher, are frequently encountered. In contrast, in the present invention, feedback is used to provide a bias point that is insensitive to amplifier offsets (the DC output of our amplifier will be equal to the DC input offset, i.e. <<10mV) while having high gain at "noise frequencies".

Claims 1-5, 7-9, 11, 17, 24, 25 and 28 stand rejected under 35 U.S.C. 102(b) as being anticipated by Sauer (US 6,064,257, hereinafter, Sauer). Sauer fails to disclose a load further comprising cascoded transistors coupled to the amplifying means and a power supply, the load being adapted to protect the amplifying means from interfering signals.

While Sauer references the use of amplifiers, it does not disclose the use of cascoded transistors as loads as in the present invention. This is clear in that the cascoded transistors in the present invention are located at the beginning of the

amplifier chain where the signal levels are lower. Such is not the case in the Sauer invention. The MOS elements identified by the Examiner in Sauer are toward the end of the amplifier chain and are used as current mirrors of the common mode feedback stage and are not adapted to protect the amplifying means from interfering signals. Further, there is a further significant distinction between the present invention and Sauer in that Sauer uses resistors for noise generation and amplifiers for amplification only.

Specifically, the Examiner states that Figures 5 to 7 of Sauer disclose a common source amplifier (MP1-4). However, this is incorrect. Transistors Q15, MP1, and, MP3 ((Q16, MP2, and, MP4) form a current mirror such that the variation (signal) of the Q13 (Q14) collector current is copied (i.e. mirrored) to the MP1 (MP2) drain current and into the capacitor C8. The voltage across capacitor Co is, thus, the integral of the difference in collector currents of Q13 and Q14. In fact, Sauer refers to this block as a differential integrator (e.g. column 7 lines 39-42). Another function of this block is to provide bias feedback to the inputs of Q1 and Q2 to stabilize the DC operating point. MP5 and MP6 sense the capacitor C8 node voltages and the average is derived by means of R16 and R17. This average is controlling the bias current through Q15 and Q16 which set the DC potential of nodes H and J. Since these node voltages are DC coupled to Q1 and Q2 a common-mode feedback loop is formed setting the entire circuit bias point into an active region avoiding "railing" (the term used by Sauer). Noise is not generated in 52 but in resistors R13 and R14 as well as shot noise in Q1 and Q2 (col. 8 lines 18-24), but with the typical values presented by Sauer, the resistor noise seems to dominate by more than a factor of ten (R=100kOhms vs. gm=0.24mS).

In particular, the Sauer circuit does not include any cascode circuitry in the amplifier path (G1-3). As seen in Figure 5, any ripple on Vcc will be directly coupled (as a common-mode voltage) to each amplifier output. This common-ode ripple will be converted to a differential voltage by circuit imbalances and will be dominated by the differential integrator.

Further, Sauer fails to disclose how to maximize the noise/interference ratio. Sauer further fails to disclose (as claimed in the present invention) sizing derivation, the

use of cascoded transistors to diminish the coupling from supplies to the signal path, and, the use of standard digital CMOS technology features.

It is improper for an Examiner to modify a single reference, here Sauer, to support a rejection. There must be no differences between the claimed subject matter and the prior art reference for a 102 rejection to be proper. As noted above, the topology of the present invention is arranged to obtain the advantage of protecting the amplifying means from interfering signals, a benefit not obtained by Sauer due to its differing circuit topology. Claims 2-5, 7-9, 11, 17, 24, 25 and 28 depend from amended claim 1 and recite further limitations in combination with the novel elements of claim 1. Therefore, the allowance of claims 1-5, 7-9, 11, 17, 24, 25 and 28 is respectfully requested.

5.) Claim Rejections – 35 U.S.C. § 103 (a)

Claims 11 and 13-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoffman. Claims 11 and 13-15 depend directly or indirectly from amended claim 1 and recite further limitations in combination with the novel elements of claim 1. As noted above, Hoffman alone fails to disclose all of the elements of Claim 1. Therefore, the allowance of claims 11 and 13-15 is respectfully requested.

Claims 3, 9 and 24-30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoffman in view of Sauer. Claims 3, 9 and 24-30 depend directly or indirectly from amended claim 1 and recite further limitations in combination with the novel elements of claim 1. As noted above, neither Hoffman nor Sauer alone disclose all of the elements of Claim 1. In combination, these references, cannot disclose all of the elements of claims 3, 9 and 24-20. Therefore, the allowance of claims 3, 9 and 24-30 is respectfully requested.

CONCLUSION

In view of the foregoing remarks, the Applicant believes all of the claims currently pending in the Application to be in a condition for allowance. The Applicant, therefore, respectfully requests that the Examiner withdraw all rejections and issue a Notice of Allowance for all pending claims.

The Applicant requests a telephonic interview if the Examiner has any questions or requires any additional information that would further or expedite the prosecution of the Application.

Respectfully submitted,

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